EFFECT OF RUMEN-PROTECTED METHIONINE ON WHOLE-BODY PROTEIN SYNTHESIS IN GOATS

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Introduction

It has been considered that the most likely first-limiting amino acids in ruminants are methionine, lysine and possibly threonine. Therefore, attempts have been made to supply these amino acids by means of administrating them directly into abomasum so as to be efficiently utilized by a host ruminant. Recently, various amino acid preparations that could escape from degradation to ammonia in the rumen, referred to as rumen-protected amino acids, have become available, although their biological efficacy is not well clarified.

The present study was conducted to investigate the effect of rumen-protected methionine (RPMet) on whole-body protein synthesis and nitrogen balance in goats.

Materials and Methods

Three female Japanese Saanen goats, weighing 30 to 40 kg, were used, and given daily an urea diet consisting of 500 g semi-purified diet based on urea as a major N source and 300 g hay cube once a day for 7 days. The composition of the semi-purified diet was as follows (%): maize starch, 60.5; glucose, 20.0; cane molasses, 10.0; sodium chloride, 2.0; calcium diphosphate, 2.0; mineral mixture (Campbell et al., 1963), 2.0; urea, 3.5. The goats were then transferred to metabolism cages, and given the same diet for further 7 days, the last 3 days of which were assigned to the collection period of urine and feces to measure N balance. On day 7, primed-infusion of L-[^{15}N] leucine was done via left jugular vein at a dose of 1.1 μmole/hour per kg body weight for 6 hours with a priming dose equivalent to the 2-hour infusion rate. From right jugular vein, blood samples were taken to ascertain whether or not a plateau enrichment was attained by the end of the infusion period. The goats were then given the same basal diet supplemented with 1.5 g/day of DL-methionine for 7 days, and similarly treated. For the following 21 days, the goats were treated similarly except that RPMet (Lactet® containing 30% DL-methionine, Nippon Soda Co. Ltd., Japan) was supplemented at 5.0 g/day instead of methionine, and the animals were treated similarly. The entire experiment was repeated with the same animals in the opposite order of supplement treatments so that a possible residual effect of the previous dietary treatment was minimized.

Blood samples were centrifuged to separate the plasma fraction. Details of derivatization of free amino acids in the plasma were given elsewhere (Muramatsu et al., 1987). For the calculation of [^{15}N]leucine enrichment, mass fragment ions at m/z=182 and 183 were chosen. Calculation of leucine flux and whole-body protein synthesis was done as described previously (Muramatsu et al., 1988).

Results and Discussion

The values for N intake, N excretion, N balance

TABLE 1. EFFECT OF METHIONINE (MET) AND RUMEN PROTECTED METHIONINE (RPMet) SUPPLEMENTS ON NITROGEN UTILIZATION AND WHOLE-BODY PROTEIN SYNTHESIS IN GOATS FED AN UREA DIET

Supplement	None	Met	RPMet	Pooled SEM
	($g/kg^{0.75}$ body weight per day)			
N intake	1.26	1.28	1.27	0.02
N excreted in				
feces	0.40	0.42	0.41	0.02
urine	0.64[a]	0.60[a]	0.40[b]	0.03
N balance	0.22[a]	0.26[a]	0.46[b]	0.04
Protein synthesis	12.0[a]	15.2[a]	26.2[b]	1.4

DL-methionine and RPMet (Lactet® containing 30% DL-methionine, Nippon Soda Co. Ltd., Tokyo) were fed daily at amounts of 1.5 g and 5.0 g, respectively.

[a,b]Significantly different at $p < 0.05$.

and whole-body protein synthesis are given in table 1. It was shown clearly that N balance of the goats was improved slightly but not significantly by supplementing with methionine, and to a considerable extent by supplementing with RPMet. The improved N balance was almost completely accounted for by reduced N excretion in urine when supplemented with RPMet. This may mean that the supplemented RPMet would be utilized efficiently by the goat as the substrate for body protein synthesis. The above hypothesis was further substantiated by measuring whole-body protein synthesis *in vivo*. As was expected, whole-body protein synthesis was drastically enhanced by supplementing with RPMet and to a small, nonsignificant extent with methionine.

Thus, it was concluded that the dietary RPMet supplement was useful in improving N balance and enhancing whole-body protein in goats when urea was given as a major N source of the diet.

(**Key Words**: Rumen-Protected Methionine, Whole-Body Protein Synthesis, Goats)

Literature Cited

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